भारतीय मानक
Indian Standard

IS 233 (Part 3) : 2021

वस्त्रादि — कपास रेशों की लंबाई प्राचलों के निर्धारण के लिए विधियां

भाग 3 मोटाई अवलोकन विधि द्वारा लंबाई और लंबाई वितरण का अनुमान

(दूसरा पुनरीक्षण)

Textiles — Methods for Determination of Length Parameters of Cotton Fibres

Part 3 Estimation of Length and Length Distribution by the Thickness Scanning Method

(Second Revision)

ICS 59.060.10

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भारतीय मानक ब्यूरो
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November 2021 **Price Group 3**

Physical Methods of Tests Sectional Committee, TXD 01

FOREWORD

This Indian Standard (Part 3) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Physical Methods of Tests Sectional Committee had been approved by the Textiles Division Council.

This standard was first published in four parts in 1954 which covered methods for determination of various length parameters of cotton fibres using Ball (Sledge) Sorter Method, Ahmad-Nanjundayya Stapling Apparatus Method and Baer (Comb) Sorter Method. This standard was subsequently revised in 1978 to include two more methods (Part 5 and Part 6) namely, Thickness Scanning Method (Uster Stapling Apparatus) and Optical Scanning Method (Digital Fibrograph). Later in year 1989 through an amendment No. 2, Ball (Sledge) Sorter Method (Part 3) and Ahmad-Nanjundayya Stapling Apparatus Method (Part 4) were deleted as these methods are not used commercially and accordingly, Part 5 and Part 6 were re-designated as Part 3 and Part 4 respectively.

This standard has been revised again to incorporate the following major changes:

a) Amendments issued have been incorporated.; and
b) References to Indian Standard has been updated.

This Indian Standard has been published in four parts. The other parts in the series are:

Part 1 General
Part 2 Estimation of length and length distribution by the array method
Part 4 Estimation of length, uniformity ratio and uniformity index by the optical scanning method

The fibre length of cotton is directly related to its spinning performance; in general, longer cottons can be spun to finer counts. The method of estimating fibre length or ‘staple’ of cotton used in the trade has long been accepted to be liable to considerable subjective and personal errors, and the need for accurate methods of determining the mean fibre length of cotton and the proportion by weight of fibres of different length grades in cotton has long been recognized.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.

Indian Standard

TEXTILES — METHODS FOR DETERMINATION OF LENGTH PARAMETERS OF COTTON FIBRES

PART 3 ESTIMATION OF LENGTH AND LENGTH DISTRIBUTION BY THE THICKNESS SCANNING METHOD

(Second Revision)

1 SCOPE

This standard (Part 3) prescribes a method for estimation of mean fibre length, effective length, percent short fibres and coefficient of variation of length by the thickness scanning method.

2 REFERENCES

The standard given below contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of this standard.

IS No.	*Title*
233 (Part 1) : 2021	Textiles — Methods for determination of length parameters of cotton fibres: Part 1 General
233 (Part 2) : 2021	Textiles — Methods for determination of length parameters of cotton fibres: Part 2 Estimation of length and length distribution by the array method

3 TERMS AND DEFINITIONS

For the purpose of this standard, the definitions given in IS 233 (Part 1) shall apply.

4 PRINCIPLE

The thickness of an aligned tuft of fibres is measured at predetermined distances from the aligned end. It is assumed that the mean cross-sectional area of the fibres is the same at all points along the tuft and that the thickness readings are proportional to the number of fibres. A cumulative length frequency diagram is obtained from the measurements.

5 APPARATUS

5.1 Uster Staple Diagram Apparatus (*see* Note) — It essentially consists of:

a) a mechanical comb sorter and tuft holder;
b) a tuft forming unit; and
c) a thickness measuring device.

NOTE — Mention of the name of specific (or proprietary) instruments is not intended to promote or give preference to the use of these instruments or exclude the use of other suitable instruments.

6 PROCEDURE

6.1 Calibrate and check the apparatus according to manufacturer's instructions.

6.2 Swivel back the upper comb bank and place the representative sliver [*see* **5.1.1** of IS 233 (Part 1)] across the lower bed of combs, so that about 30 mm length projects beyond the nearest comb. Press the sliver into the combs with a rake. Lower the upper combs.

6.3 Use the sliding fibre grip to square the sliver and bring its end in alignment with the first comb.

6.4 Drop the first lower comb; slide the fibre grip towards the aligned end of the sliver, seize the projecting fibres, move the grip back to the mid-stop, and transfer the fibres on to the transport comb by operating the crank on the right side. Repeat the operation until all the protruding fibres are transferred. Thereafter, raise the foremost upper comb and continue the transfer of fibres in the same manner. Build up a sufficiently thick (1 mm) aligned fringe of fibres, dropping or raising the foremost combs one by one, and transferring more fibres on to the transport comb.

6.5 Detach the transport comb along with the aligned fringe of fibres, and place it on the tuft forming device. Insert the aligned end of the fringe of fibres into the slot in the clamping block, and clamp the fibre ends tight by means of the plunger.

6.6 Remove the clamping block and mount it in the thickness measuring device. Guide the tuft through the narrow gauging slot and place a plush cover over the protruding length. Slowly lower the dial gauge feeler into the slot by operating the knob on the left; a vibrator automatically starts working and keeps the feeler in vibration for 30 s, after which it stops. Take the reading on the dial gauge after the vibrator stops working. The first reading is at 4 mm from the aligned end of the tuft. Raise the dial gauge. Move the tuft 2 mm towards the left by turning the crank on the right, and take the next thickness reading. Continue to take thickness readings at 2 mm intervals until the slot is empty.

6.7 The first thickness reading at 4 mm is generally the highest and is assumed to represent 100 percent of the fibres and all subsequent readings are expressed as percentage of this maximum thickness. However, in some cases, the maximum thickness may occur at a higher distance and this maximum value should be taken as the base for calculations. Enter the percent thickness values against distances from the aligned end.

7 CALCULATION AND EXPRESSION OF RESULTS

7.1 Construct the staple diagram (based on frequency by number) from the dial readings at successive intervals from the aligned end (*see* Table 1).

7.2 Make geometric constructions as given in Fig. 1 and Fig. 2 of IS 233 (Part 2) and obtain effective length and percent short fibre as shown in **7.1.3** and **7.1.5** of IS 233 (Part 2).

7.3 Work out fibre length distribution, mean length and coefficient of variation of fibre length from the data as shown in Table 1, or from the staple diagram as detailed in **7.1.6** of IS 233 (Part 2).

8 REPORT

Report shall include the following information:

a) Mean fibre length in mm (rounded off to one decimal place);
b) Effective length in mm (rounded off to one decimal place);
c) Percent short fibres (rounded off to two significant figures); and
d) Coefficient of variation of length (rounded off to two significant figures).

Table 1 Length Frequency Data from Tests with Uster Group Diagram Apparatus

(*Clauses* 7.1 *and* 7.3)

Group Length (Distance from Aligned End), li	Dial Reading	Cumulative Frequency	Percentage Group Frequency, *fi*	*fi li*	*fi li*^{2}
(1)	(2)	(3)	(4)	(5)	(6)
mm					
40	0	0	0	0	0
38	4	0.3	0.3	11.4	433.2
36	10	0.8	0.5	18.0	648.0.
34	32	2.5	1.7	57.8	1965.2
32	82	6.4	3.9	124.8	3993.6
30	116	12.9	6.5	195.0	5850.0
28	286	22.2	9.3	260.4	7291.2
26	410	31.8	9.6	249.6	6489.6
24	542	42.1	10.3	247.2	5932.8
22	668	51.8	9.7	213.4	4694.8
20	788	61.1	9.3	186.0	3720.0
18	890	69.0	7.9	142.2	2559.6
16	980	76.0	7.0	112.0	1792.0
14	1050	81.4	5.4	75.6	1058.4
12	1102	85.5	4.1	49.2	590.4
10	1150	89.0	3.5	35.0	350.0
8	1204	93.3	3.3	26.4	211.2
6	1234	95.6	2.3	13.8	82.8
4	1290	100.6	4.4	17.6	70.4
			$\sum fi = 100.0$	$\sum fi\,li = 2\,035.4$	$\sum fi\,li2 = 47\,733.2$

$$\text{Mean length } (lm) = \frac{\sum fi\,li}{\sum fi} = \frac{2035.4}{100} = 20.4\ mm$$

$$Variance = \frac{\sum fi\,li - \frac{\left(\sum fi\,li\right)^2}{\sum fi}}{\sum fi} =$$

$$\frac{(47733.2 - 41428.5)}{100} = 63.047$$

Standard deviation (σ) = $\sqrt{variance} = \sqrt{63.047} = 7.94$

Coefficient of variation (CV) =

$$\frac{\sigma}{lm} \times 100 = \frac{7.94}{20.35} \times 100 = 39\ percent$$

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Physical Methods of Test Sectional Committee, TXD 01

Organization	*Representative(s)*
ICAR-Central Institute for Research on Cotton Technology, Mumbai	Dr Pradeep Mandhyan (***Chairman)***
Bidhata Industries Pvt Ltd, Mumbai	Shri R. K. Pacheriwala Shri Rohit Pacheriwala (*Alternate*)
Central Silk Technological Research Institute, Bengaluru	Dr Subhas V. Naik Dr Prakash Bhat (*Alternate*)
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Indian Jute Industries Research Association, Kolkata	Ms Saumita Choudhury Shri D. P. Gon (*Alternate*)
Indian Jute Mills Association, Kolkata	Shri S. K. Chandra Shri J. K. Behera (*Alternate* I) Shri Rama Shankar Upadhyay (*Alternate* II)
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Office of Textile Commissioner, Mumbai	Shri Sivakumar S. Shri N. K. Singh (*Alternate*)
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Testtex India Laboratories Pvt Ltd, Mumbai	Shrimati Meeta Shingala Shri Mahesh Sharma (*Alternate*)
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Textiles Committee, Mumbai	Shri Kartikay Dhanda Dr P. Ravichandran (*Alternate*)

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Member Secretary

Shri J. K. Gupta
Scientist 'E' (Textiles), BIS

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